

**MACS Worldwide 2011 Convention and Trade Show
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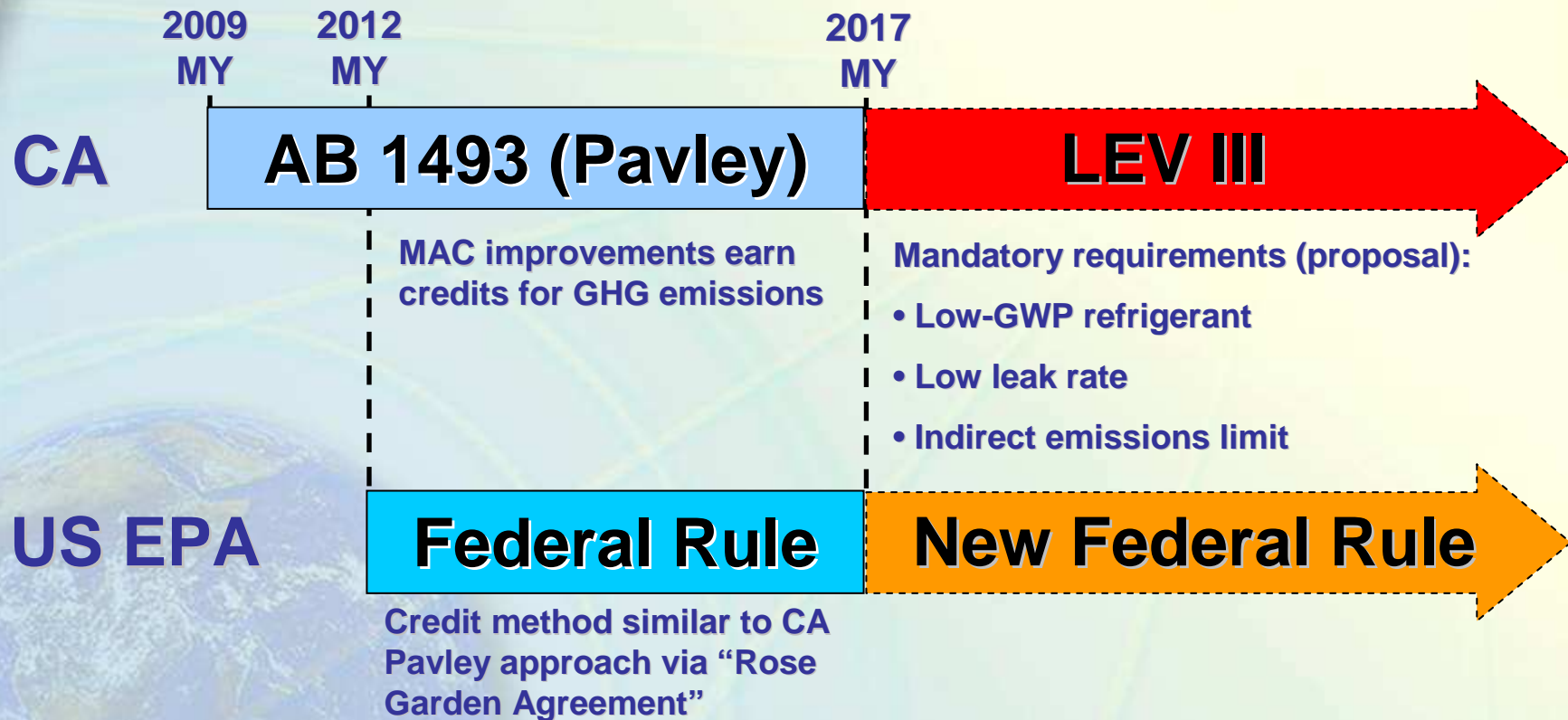
California's Regulatory Proposal for Reducing Greenhouse Gas Emissions from Mobile Air Conditioning

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California Air Resources Board



Evolution of Regulations



LEV III MAC Requirement 1: GWP \leq 150 (100% for 2017 MY)

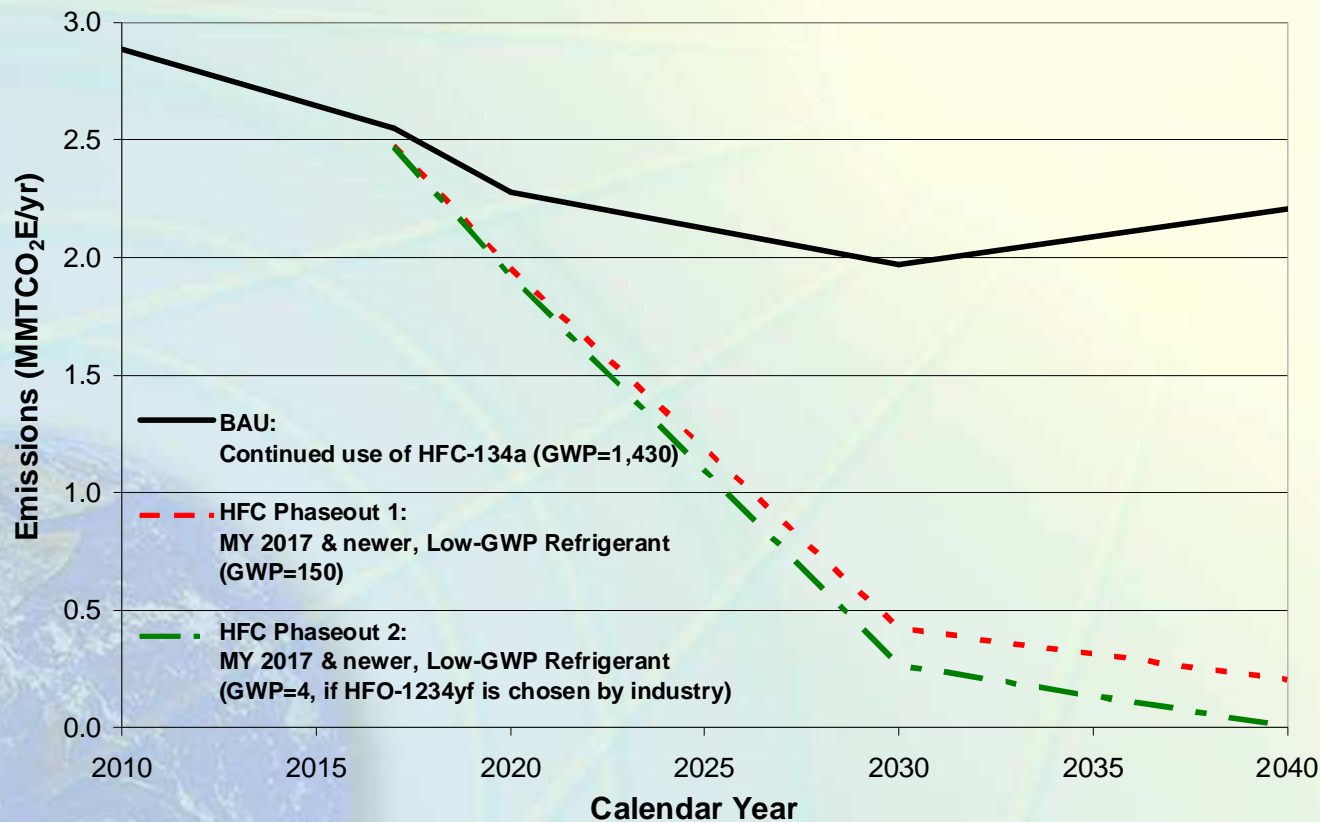
- **Benefits**
 - Provides a nearly 90% direct emission reduction
 - Harmonizes with EU's MAC Directive (Directive 2006/40/EC)
- **Potential candidates / SNAP approval: HFC-152a (approved), R744 (CO₂) (pending), and HFO-1234yf (pending)**
- **Movement toward use of low-GWP refrigerant**
 - GM and Aston Martin plan to introduce HFO-1234yf for 2017 or prior models
 - Chemical manufacturers indicated their ability to provide sufficient supply of HFO-1234yf with firm purchase commitment and sufficient lead time
 - Several stakeholders have expressed concerns about proposed timeline
 - A multi-year phase-in as proposed by some stakeholders would delay climate benefits, result in larger HFC banks, and cause more potential cross-contamination during service

LEV III MAC Requirement 2: Fleet Average Leak Rate ≤ 9 g/yr

- **Low leak rate is important, regardless of refrigerant used**
 - Maintain efficiency
 - Reduce need for maintenance
- **Leak rate will be evaluated using SAE J2727-type standards for AC using low-GWP refrigerants**
- **9 g/yr (refrigerant) is achievable**
 - 18 g/yr around 2003 MY (US EPA), 50% reduction feasible (I-MAC)
 - 14-15g/yr for 2009 MY (Minnesota MAC Leakage Database, CA MAC certification programs, Ward's Auto data), depending on how leak rates are averaged
 - Some commercially available MAC platforms using premium technologies are already achieving 9 g/yr
 - Some carmakers appear on track for meeting 9 g/yr
 - Several stakeholders have expressed concerns about stringency of proposed leak rate limit

LEV III MAC Requirements 1 & 2: Estimated Emission Reduction

Refrigerant Emissions from Light-Duty Vehicles in California



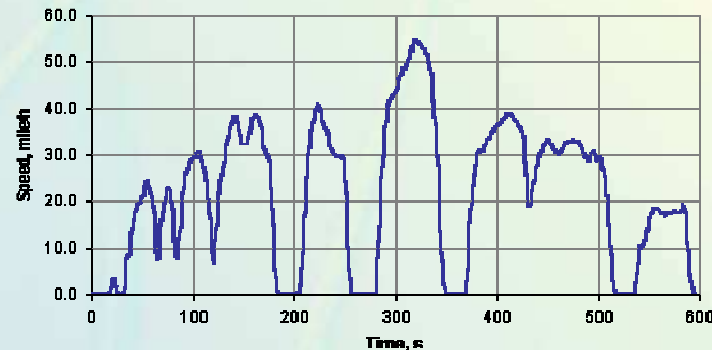
Potential emission reduction: $\geq 90\%$ by 2040

LEV III MAC Requirement 3: Indirect Emissions Standard

- **ARB is proposing to develop a fleet average MAC indirect emissions standard**
 - Evaluate through a Whole-Vehicle Performance Test Procedure
- **For LEV III going to the Board this year, ARB will propose initial adoption of US EPA's Idle Test procedure and AC Efficiency Credits scheme as a placeholder**
 - Amend the regulation after developing a performance test procedure and an MAC indirect emissions standard in ~2 years
 - Implementation to begin in 2017
- **Performance test benefits**
 - Able to evaluate all current and new technologies under realistic solar load and driving conditions
 - Enforceable

LEV III MAC Requirement 3 (Cont.): Proposed Performance Test Procedure

- **Elements of proposed test procedure:**
 - Simulated solar load (e.g., 1 hour soak at 850 W m^{-2})
 - Moderate ambient cell conditions (e.g., 25°C , 50% RH)
 - Transient test cycle (e.g., SC03+HWFET)
 - Evaluate AC during both initial cool down and steady state temperature control
- **Difference between CO_2 from AC-off cycle and CO_2 from weighted average of AC-on cycles (cool down and steady state) must be \leq the standard**



SC03 Driving Cycle

Summary

- **California's new vehicle GHG emission standards for 2017 MY and beyond will be incorporated into the Low Emission Vehicle regulation (LEV III)**
- **Mandatory requirements for MAC proposed under LEV III:**
 - Low-GWP refrigerant
 - Limit on leak rate
 - Limit on indirect emissions (evaluated by performance test)
- **LEV III is under development, and is expected to go to the Board in October, 2011. We are still accepting comments on all aspects of the proposal.**

ARB Contacts

MAC Direct Emissions

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MAC Indirect Emissions

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For more information, visit

<http://www.arb.ca.gov/cc/hfc-mac/hfc-mac.htm>

<http://www.arb.ca.gov/msprog/levprog/leviii/leviii.htm>